

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 997 176 A2

(12)

EUROPEAN PATENT APPLICATION

125

(43) Date of publication:

03.05.2000 Bulletin 2000/18

(51) Int. Cl.⁷: A63G 31/16

(21) Application number: 99203369.6

(22) Date of filing: 14.10.1999

(84) Designated Contracting States:

AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE

Designated Extension States:

AL LT LV MK RO SI

(30) Priority: 28.10.1998 EP 98203647

(71) Applicant: Peripherals N.V.
2970 Schilde (BE)(72) Inventor: Collignon, Patrick
2970 Schilde (BE)

(54) Robotised virtual reality motion simulator-II

(57) A robotised motion simulator for amusement rides, flight simulators or any other form of motion system used for example for virtual reality experiences offering a more flexible and versatile simulation system.

The system consists out of an industrial robot used as programmable controlled arm to manipulate and move a user holding frame in a much larger space envelope and with more degrees of freedom than existing motion systems based on movable platforms.

The user holding frame is moved by a robot through

a sequence of motions, synchronized with the image of a visual display system.

The use of industrial robots for the application offers the potential to make the rides more personalized, more realistic and provides construction and control at much lower cost.

The standard controls of an industrial robot will allow for a highly simplified interactive motion control system

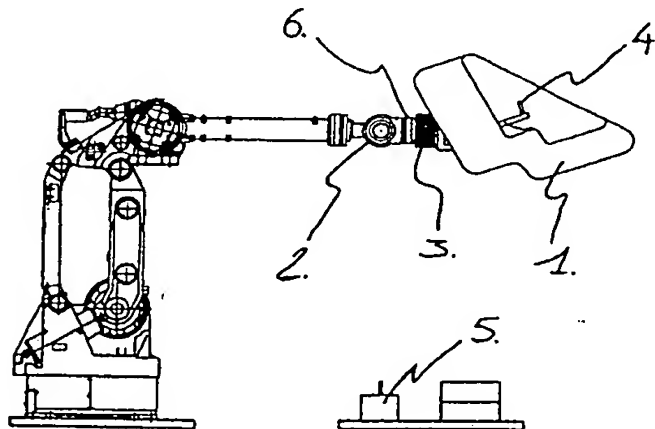


FIG. 1

Description

BACKGROUND OF THE INVENTION

[0001] This invention relates to an improved motion simulator device, and to amusement ride devices that combine both visual effects and motion of the user/passenger to obtain an overall effect as realistic as possible.

[0002] These motion systems move users or passengers over short distances in different directions, in synchronism with the motion picture, so they experience forces similar to those of the people in the motion picture.

[0003] Over the years, there have been a number of proposals for motion systems based on support platforms used in theatrical environment. Examples of such patents are provided by PCT/AU89/00124 and PCT/US86/02763, PCT/WO87/03816, PCT/WO89/09086, US/4.584.896, US/5.791.903.

In these examples, a platform intended to support a number of people in a theater complex is able to be tilted in at least some directions. The movements are generated either by means of hydraulic cylinders or by means of mechanical levers.

The resultant motion is intended to subject passengers to forces similar to those of passengers in a motion picture image, which provides enhanced entertainment.

[0004] The above mentioned constructions consist out of a platform (onto which seats are attached) tilted or moved by means of hydraulic actuators or flexible cables. These constructions limit the different amount of movements that can be generated and these movements are limited in range, due to the fixed mounting base.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0005] In search for more realistic and versatile movements to increase the enhanced entertainment or training effect (flight simulators) the volume (space envelope) in which the motion is generated must be enlarged, together with the degrees of freedom of the motion that must be increased.

[0006] The biggest technical constraint, with the existing simulator platforms is the fixation of the passenger holding platform with the seats to a fixed base through cylinders or mechanical levers.

The current motion systems have unique and specific mechanical and control designs, which makes the overall product expensive.

[0007] The present invention seeks to provide an improved motion simulator and, at least in a preferred form, offer a higher level of control flexibility, more realistic motion patterns (like full rolls) in a larger space envelope and at much lower product cost.

[0008] The invention uses the control flexibility of standard industrial robots and their degrees of freedom

to move a user-holding frame through a motion program.

[0009] The preferred embodiment consists out of a user-holding frame that is attached to the mounting flange of the wrist of the industrial robot.

[0010] The users or passengers that want to experience the ride, take place in the user-holding frame. This frame offers seats including safety devices (restraints) to protect the users during the ride.

[0011] The users either wear a head-set that includes visual display or face a screen onto which a picture is projected.

[0012] The user-holding frame can be shaped in any physical form, depending on the attraction or application.

Given the mechanical payload of the industrial robot, the user-holding frame can hold more than one seat.

The control system of an industrial robot allows unlimited flexibility and real time control alterations by the user offering different and personalized rides adjusted to each individual.

Virtual reality applications require these real time motion alterations at low product cost.

[0013] Depending on the physical configuration of the preferred embodiment in its way it is attached to the robotwrist, the user holding frame can make full roll, pitch or yaw motions.

[0014] Fig. 1 shows an example of a design for the set up of an industrial robot with a user-holding frame. The user-holding frame is equipped with one seat. In the way the user-holding frame (1) is attached to the robot wrist (2) three dimensional motion is possible and the user/passenger can be subjected to full roll motion.

[0015] A load sensing device (3) is installed between robotwrist and user-holding frame to prevent dynamical overload on the mechanical arm or protect the user or environment against collision.

The user-holding frame is equipped with a dead-man-switch (4) to protect the user/passenger in case of emergency. If the user releases the dead-man-switch the robot goes into emergency stop.

The user-holding frame is equipped with a docking device, which is used as mechanical fixation when the robot returns to its home position (5). User/passengers can step in and out under a safe and mechanical stable situation.

[0016] Different ride programs can easily be stored in the robot controllers memory and can be instantly selected by the user. Different parameter settings, like acceleration or speed, personalizes the experience of each individual ride.

[0017] Fig. 2 shows a set-up with multiple user-holding frames (7).

For entertainment purposes, it is important to achieve a high utilization level of the equipment.

The multiple user-holding frames and the robot are equipped with a quick change device. Fig. 1 shows the

location of such a quick change device (6).

With the quick change device, the robot can detach the user-holding frame in its docking station Fig. 1 (5). In this set-up, the user/passengers can step in and out of the user-holding frame, while the robot performs the motion simulation with another user-holding frame.

Several of such user-holding frames can be engineered to increase the utilization level.

Claims

1. A motion simulator apparatus; using an industrial robot for the generation of a motion pattern synchronized with a visual display system; comprising an industrial robot, a user-holding frame attached to the robotwrist which can accomodate passengers and head mounted visual display systems to view a picture.
2. An apparatus according to claim 1, wherein a quick change device is incorporated for fast exchange of multiple user-holding frames, each to be placed in docking stations.
3. A motion simulator apparatus comprising multiple industrial robots to hold a larger user-holding frame with multiple seats.
4. An apparatus according to claim 1 or claim 3, wherein a load safety system or anti-collision device is installed between the robot(s) and the user-holding frame.
5. An apparatus according to claim 1 or claim 3, wherein different effects are incorporated in the user-holding frame, such as to simulate wind velocity (air nozzles or blowers) or humidity (spray of water) and sound.
6. An apparatus according to claim 1 or claim 3, wherein a steering device such as a joy stick is installed to control robot motion.
7. An apparatus according to claim 1 or claim 3, wherein the axis of the user-holding frame is installed in line with the roll axis of the robotwrist giving opportunity for full roll motion.
8. An apparatus according to claim 1 or claim 3, wherein the roll axis of the robotwrist is installed perpendicular to the axis of the user-holding frame giving opportunity for full yaw motion.
9. An apparatus according to claim 1 or claim 3, wherein the roll axis of the robotwrist is installed sideways to the axis of the user-holding frame giving opportunity for full pitch motion.

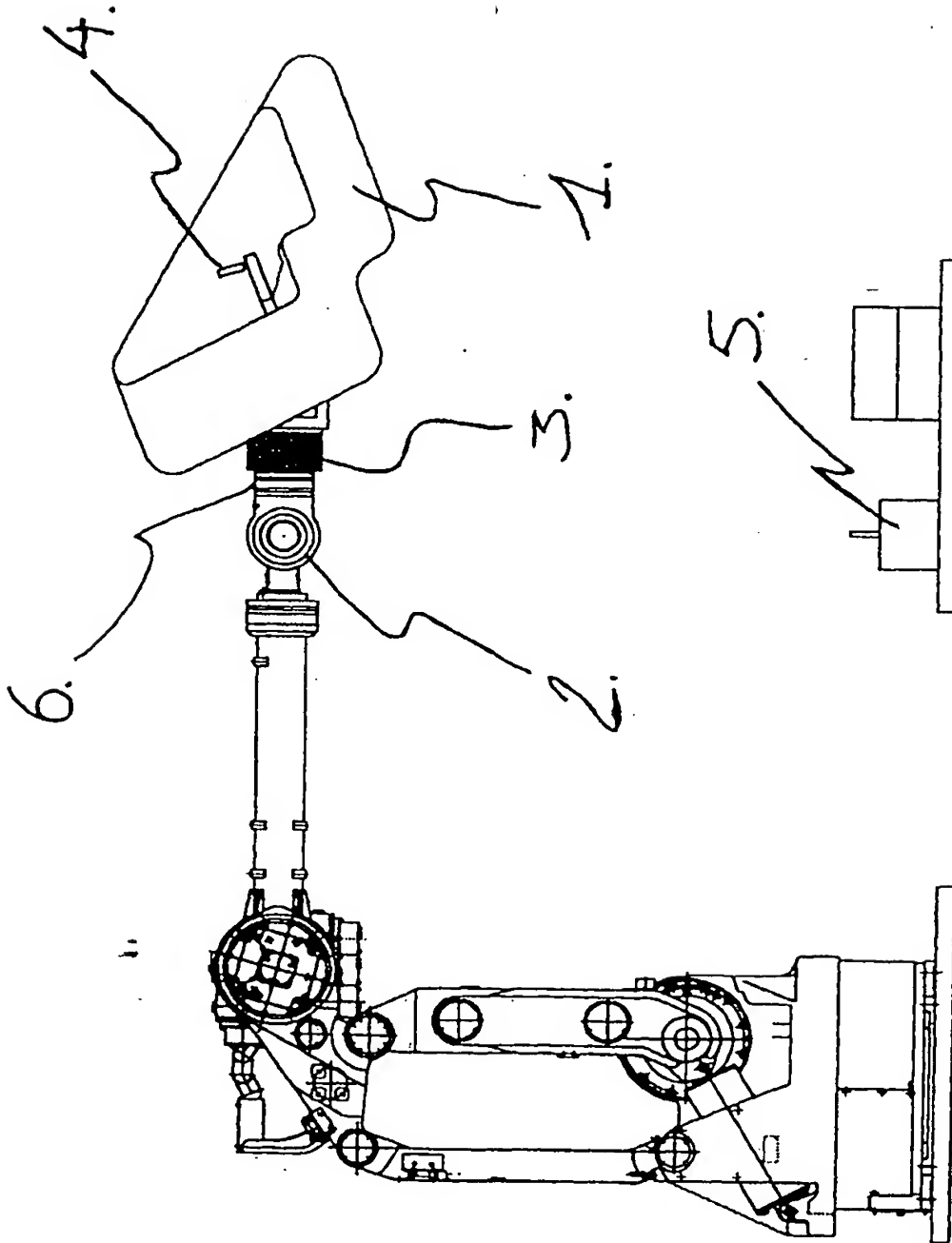
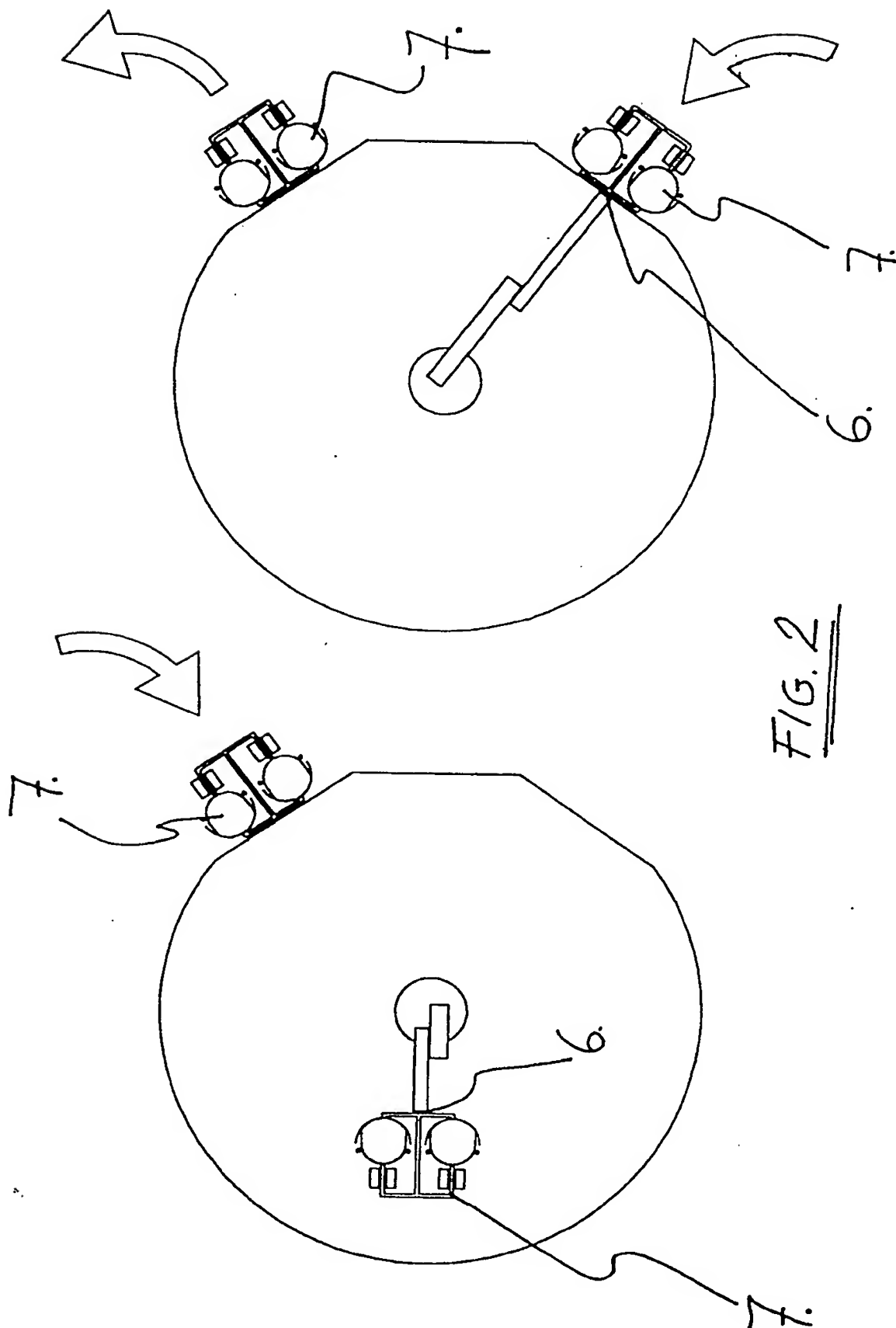
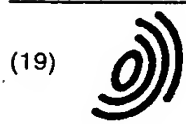


FIG. 1





Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 997 176 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
21.02.2001 Bulletin 2001/08.

(51) Int. Cl.⁷: A63G 31/16

(43) Date of publication A2:
03.05.2000 Bulletin 2000/18

(21) Application number: 99203369.6

(22) Date of filing: 14.10.1999

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: 28.10.1998 EP 98203647

(71) Applicant: Peripherals N.V.
2970 Schilde (BE)

(72) Inventor: Collignon, Patrick
2970 Schilde (BE)

(54) Robotised virtual reality motion simulator-II

(57) A robotised motion simulator for amusement rides, flight simulators or any other form of motion system used for example for virtual reality experiences offering a more flexible and versatile simulation system.

The system consists out of an industrial robot used as programmable controlled arm to manipulate and move a user holding frame in a much larger space envelope and with more degrees of freedom than existing motion systems based on movable platforms.

The user holding frame is moved by a robot through

a sequence of motions, synchronized with the image of a visual display system.

The use of industrial robots for the application offers the potential to make the rides more personalized, more realistic and provides construction and control at much lower cost.

The standard controls of an industrial robot will allow for a highly simplified interactive motion control system

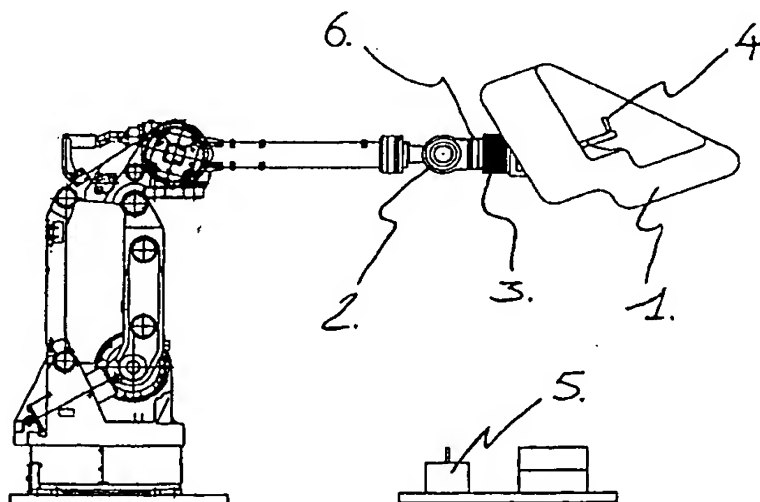


FIG. 1

EP 0 997 176 A3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 20 3369

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Incl.7)
X	JP 05 158399 A (ORII:KK) 25 June 1993 (1993-06-25) * abstract *	1,7,8	A63G31/16
X,D	US 4 584 896 A (LETOVSKY HOWARD) 29 April 1986 (1986-04-29) * column 1, line 14 - line 18 * * column 4, line 19 - line 37; figure 1 *	1,6-9	
X,D	US 5 791 903 A (SOMWONG BANYAT ET AL) 11 August 1998 (1998-08-11) * column 1, line 16 - line 21 * * column 2, line 60 - column 3, line 62; figures 1,2 *	1,3,6,7, 9	
A	JP 03 066390 A (FUJI ELECTRIC CO LTD) 22 March 1991 (1991-03-22) * abstract *	1,5	
A	US 5 282 772 A (NINOMIYA SHOZO ET AL) 1 February 1994 (1994-02-01) * column 1, line 48 - line 56 *	5	TECHNICAL FIELDS SEARCHED (Incl.7)
A,D	WO 89 09086 A (BRISTOW ENGINEERING OF HASTING) 5 October 1989 (1989-10-05) * abstract *	1	A63G
A,D	WO 87 03816 A (INTAMIN INC) 2 July 1987 (1987-07-02) * abstract *	1	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28 December 2000	Examiner Baert, F
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03 02 (P4/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 20 3369

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

28-12-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 05158399 A	25-06-1993	NONE	
US 4584896 A	29-04-1986	NONE	
US 5791903 A	11-08-1998	US 5453011 A	26-09-1995
		AU 4284296 A	06-06-1996
		WO 9615514 A	23-05-1996
		AU 7171494 A	03-01-1995
		WO 9429828 A	22-12-1994
JP 03066390 A	22-03-1991	JP 2844702 B	06-01-1999
US 5282772 A	01-02-1994	JP 5115619 A	14-05-1993
		KR 9514770 B	14-12-1995
WO 8909086 A	05-10-1989	NONE	
WO 8703816 A	02-07-1987	US 4752065 A	21-06-1988
		AU 585692 B	22-06-1989
		AU 6832887 A	15-07-1987
		DE 3681736 A	31-10-1991
		DE 3681736 D	31-10-1991
		EP 0250562 A	07-01-1988
		JP 63502009 T	11-08-1988
		US 4798376 A	17-01-1989
		US 4874162 A	17-10-1989